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ABSTRACT

An exploration of specific deficits of learning disabled children, especially in the auditory system, is presented in this paper. Disorders of attention, perception, phonemic and visual discrimination, memory, and symbolization and conceptualization are considered. The paper develops several questions for teachers of learning disabled children to consider when developing programs of reading instruction: (1) What is the nature of the input stimulation? (2) What is the expected response from the child? (3) What is the nature of the vocabulary? (4) What is the nature of the sentence structure, and is it comparable to the child's language? (5) Is the material in keeping with the child's level of experience and interest? and (6) Will the teaching method require deductive or inductive thought processes (are the reading rules learned explicitly or implicitly)? Other factors to be considered include specific aspects of the reading materials (size or print, amount of material on the page, story length, and nature of the pictures/illustrations), level of intelligence, language, and experience. Discussion following presentation of the paper is included. (RL)

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PROCESS DEFICITS IN LEARNING DISABLED CHILDREN AND IMPLICATIONS FOR READING

Doris J. Johnson

In recent years considerable attention has been given to children who are underachieving in our schools. Special services, teacher preparation programs, legislation and research studies have been initiated in order to provide for children with unique needs. The problems are highly complex because underachievement may result from a variety of causes including sensory impairments, mental retardation, emotional disorders, lack of stimulation and specific learning disabilities. Thus, it is frequently necessary to have comprehensive diagnostic services to determine why a child is not learning. The ultimate goal is to develop an educational plan designed to meet the child's cognitive and affective needs.

Although it is clear that some children have multiple problems, the focus of this discussion is on children who are classified as having a learning disability.

The term learning disabilities, in this discussion, will be used as defined in the Education of the Handicapped Act, Part G (P.L. 91-230).

> "Children with specific learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using written or spoken language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc. They do not include learning problems which are due primarily to visual, hearing or motor handicaps, to mental retardation, emotional disturbance or to environmental disadvantage." (National Advisory Committee on Handicapped Children, 1968.)

Although there are many persistent questions and problems related to the definition, most special educators recognize that there are children who have difficulty learning even though they have good mental ability and motivation.

The population of children with learning disabilities is heterogeneous. Some have problems understanding or using spoken language; others speak well but cannot read; still others have no problems reading but they are unable to express ideas in writing. Because of the complexity of the symbol systems that children are expected to learn and because of the variability within the group, the age of identification will vary. Some youngsters, particularly those with language disorders, may be identified during the preschool years whereas others may not encounter difficulty until third or fourth grade when they are expected to acquire more abstract vocabulary or write lengthy compositions.

Many, but not all children with learning disabilities encounter difficulty learning to read. Because reading requires complex auditory, visual, linguistic and cognitive skills, it is apparent that children who have one or more deficits in processing information are apt to have problems at some point while they are learning to read. However, the nature of their problems will vary. Those who have strong visual memory abilities but poor auditory analysis skills may do fairly well if they are first introduced to a whole word - sight approach to reading. They may have problems, however, when asked to rhyme or to generalize from a known word to an unknown word. Likewise, a child with comprehension problems may do quite well on auditory-visual association tasks but be unable to interpret what he reads.

At the present time extensive research remains to be done. No firm conclusions can be drawn with regard to prediction of reading failure nor

the most effective forms of instruction for various children. We need comprehensive, longitudinal studies of both efficient and inefficient readers to determine which combination of skills are necessary for various facets of reading including decoding and comprehension. It is doubtful that simple correlational studies can provide us with all of the relevant information needed. Cluster analyses may be necessary to determine which combination of strengths and weaknesses are found among good and poor readers. It is my impression that we need to investigate the child's deficits in relation to his strengths -- or his low abilities in relation to integrities. Certain children with minor processing deficits may compensate for problems if they have strengths in other areas. For example, some with poor phonemic discrimination may actually improve when reading (the printed word) is introduced. They have good visual skills which permit them to detect differences they do not perceive auditorily.

Research on children with specific learning disabilities is emerging, but it is difficult to analyze and compare the findings in the studies because the populations and procedures are not always well defined. Intelligence is not always considered, and when it is, the measures used to assess mental ability vary greatly. Thus the composition of the groups may be quite different. Studies which include children on the basis of average nonverbal intelligence may yield quite different results from those in which auditory verbal measures are used for selection criterion.

Another reason for variability of results concerns the nature of the experimental tasks. For example, on tests of auditory discrimination, the cognitive requirements for comparing two words ("Do these sound the same or different? -- cub -- cup") are quite different from those in which the child is asked to point to a picture ("Point to cup -- cub"). Moreover, some tests

utilize nonmeaningful stimuli such as nonsense syllables whereas others use real words. Thus, in order to compare results one must know very specifically what the child was asked to do and how he was asked to respond. Nomenclature also varies. For example the term "perception" is used in many different ways, varying from a simple, low level response to relatively high levels of cognition.

Still another factor pertains to the parameters of reading that were measured in various correlational studies. It is important to know whether certain auditory processes were correlated with oral reading, or silent reading, with reading of single words or context, and with comprehension of facts or general significance of the content.

Given these issues, it is difficult at the present time to draw firm conclusions regarding the relationships between specific deficits in perception, memory or other cognitive processes and the reading problems of learning disabled children. Nevertheless, I will discuss some of the disturbances, particularly those in the auditory system, that seem to interfere with the acquisition of reading skills. Some of these problems persist through the adolescent and young adult years; hence, special attention should be provided in the early grades.

Our orientation is one that views the child as an "information processor," as one who has multiple modalities for input and output of information, and one who has the potential for a variety of complex integrative networks. Thus, as we begin an investigation of children we want to know which systems for input are intact and which may be less efficient. We also want to know which modes of response are available. In addition we are concerned with the type of information the child is able to process, particularly verbal and nonverbal.

Frames of Reference for Child Study

Several theoretical frames of reference serve as the basis for our evaluation of learning disabled children. The first pertains to the broad categories of "input -- integration -- and output." The diagnostic educator is concerned with whether a child has a disturbance at the level of input, integration, or output -- whether he has difficulty receiving and assimilating the information he receives or whether he is unable to retrieve and express that which he knows. Generally, the child who has difficulty understanding will also have limited expression. That is, a disorder of input limits the output. Thus the child who fails to comprehend spoken words cannot be expected to express more than he receives. Similarly, the child with a reading disorder cannot be expected to use written language even though he may be able to copy words. In contrast, there are children who have adequate receptive capacities but cannot encode their ideas into oral or written form. For example, a child with a word retrieval problem may comprehend language but be unable to spontaneously recall words he wishes to use. Similarly those with severe auditory-motor integration disorders or apraxia may be unable to speak though they can comprehend or read silently. Thus, it is necessary to do as complete a "systems analysis" as possible -- to determine which channels are efficient for decoding and encoding various types of information.

A second form of reference pertains to the semi-autonomous systems concept of Hebb (1963). He proposes that the brain is made up of semi-independent systems, and that at times, a given system such as the auditory or the visual system functions semi-independently from others. At times one system functions in a supplementary way with another, and at times all systems function interrelatedly. Diagnostically and educationally this concept has many im-

plications (Johnson and Myklebust, 196[illegible]. Each psychosensory system is appraised as it functions semi-autonomously, in coordination with another system, and as all of the systems function simultaneously. In our evaluations we try to ascertain whether a child can perceive, remember, and interpret what he hears, sees, or feels. We also explore the ways in which the systems work together. This being the case, we have suggested that three types of learning must be evaluated: (1) intrasensory -- that is learning requiring only one system such as audition or vision, (2) intersensory -- learning requiring two or more but not all systems, and (3) integrative -- learning requiring all of the systems functioning as a unit. The major purpose is to determine which learning "circuits" are operative or inoperative. A second is to determine how the child should be taught, that is, to clarify which combination of inputs will facilitate learning.

In our research, diagnosis, and remediation we have observed that some children are overloaded by multisensory inputs. They become confused if they are required to assimilate information through more than one system at a time. The information being received through a given sensory channel impedes integration of that being received through another. The concept of overloading has considerable relevance for instruction. If a multisensory or VAKT approach is used inappropriately, learning actually may be impeded. On the other hand, some children with learning disabilities cannot profit from intrasensory stimulation; they need input from more than one modality to help them perceive or retain information. This often is apparent among children with severe auditory disorders. When given an intrasensory auditory task they may fail to perceive unless visual stimuli such as objects, pictures, or printed words are placed before them. Other children may not profit from intrasensory visual information. Thus, they may have difficulty with certain programmed read-

ers.

The goal of instruction is to "balance the input stimulation" according to the child's pattern of strength and weaknesses. Typically it is necessary to use a series of diagnostic teaching probes in order to determine which combination of inputs is more effective.

To illustrate this principle, consider the following options or strategies that might be used for auditory perceptual training. First, one might explore intrasensory stimulation. That is, the child is asked to close his eyes and listen for pairs of words or phonemes that are similar (e.g., "bat - back"). We find that some children improve with this approach because they cannot look and listen easily; they seem overloaded with multiple stimulation. On one occasion a six-year old boy could not take a hearing test with his eyes open. He closed his eyes and raised his hand each time he heard a sound. If children are distractible it may be advantageous to reduce visual input in order to enhance learning.

A second option would utilize visual movement cues. In this instance, the teacher asks the child to watch her mouth very closely while she says the words. Occasionally it is beneficial to produce the movement pattern with no sound. After the child sees a difference between the movement patterns of the oral mechanism, the teacher says the words and asks the student to indicate whether he can <u>hear</u> the difference.

A third option is tactile or kinesthetic stimulation. The child's attention is drawn to the vibrations of the larynx on voiced sounds or to the air that is expelled when producing certain plosive sounds. Closely related to this is the option of auditory-motor production. Children are encouraged to imitate the words as precisely as possible in order to obtain better auditory feedback.

At other times the teacher may use the printed word. Rather than working on intrasensory auditory skills it may be helpful to present pairs of words and ask the child to see the difference and then to listen for the difference.

Finally, rate of auditory input might be modified. Some learning disabled children are unable to process information at the expected rate. Therefore, words are said more slowly in order to detect all of the features. Although many teachers may use one or more of these techniques with all children, our objective is to become as precise as possible in selecting a form of input that is in keeping with each child's style of learning.

In our comprehensive "systems analysis" approach we feel it is important to study more than modalities of input and output; it is necessary to examine the child's ability to process various types of information, particularly that which is verbal and nonverbal. Although we recognize that many people may use verbal mediation in processing certain types of nonverbal information we feel that it may be an oversimplification to simply define a child as an auditory or a visual learner. Rather, we should attempt to describe the type of information that he can or cannot process. For example, some children with severe reading disorders have superior visual nonverbal abilities. They have no difficulty with tasks requiring perception or memory of geometric designs, pictures, or block patterns. Their major problem seems to be with visual verbal learning. In contrast, we see children and adults with severe problems in visual nonverbal functions who have no problems in reading. Others have difficulty with both nonverbal and verbal learning.

Our diagnostic assessments should include a study of a child's ability to comprehend and use both verbal and nonverbal symbols. In addition, we attempt to determine whether he can process multiple messages. It is clear

that a child must attend to many features in any communication setting. During conversation he must listen to the words but also to the vocal inflection and observe many nonverbal features of the speaker. Similarly, when a child is reading or writing he must attend to multiple features.

Finally, in our "systems analysis" we attempt to determine the level of disturbance, that is, whether the problems result from breakdowns in attention, perception, memory, symbolization, or conceptualization. We recognize the difficulty in attempting to draw such distinctions because of the overlap and interrelationships between these functions. Furthermore, we need better measures to assess many processes. Nevertheless, research and clinical experience indicates that further investigation of the following process is needed in order to understand the needs of the learning disabled child.

Attention

Many studies pertaining to the development and disorders of attention have been completed during the past decade. (Bakan, 1966; Hallahan and Kauffman, 1976; Dykman, et al., 1971.) The significance of attention for all learning and living cannot be minimized. Cobb (1948) states that attention is necessary for all learning if not for self preservation and life itself. Indeed, one might characterize a personality by attention characteristics, that is whether an individual is persistent, flighty, or easily distracted.

Attention improves with maturation, socialization and environmental controls. Most preschoolers are somewhat distractible, but they gradually improve in their ability to select certain information and to inhibit that which is irrelevant.

Problems of attention have been observed in many learning disabled children. Strauss and Lehtinen (1947) and Cruickshank, et al. (1961) reported

that distractibility, disinhibition and perseveration were common symptoms among "brain-injured" children. Subsequently they recommended a highly structured environment so the child could perform more effectively. Kaliski (1959) indicated that it was necessary to structure the child's world spatially, temporally, contextually, and socially. Johnson and Myklebust (1967) reported that it was beneficial to structure the environment, materials, and presentation of the materials. They emphasized, however, that it is important to keep a fluid structure and to expose children to more natural settings as soon as they are able to integrate the experiences.

Research on the effectiveness of highly structured environments is somewhat limited. Cruickshank, et al. (1961) used the Strauss and Lehtinen procedures in a special classroom with a group of hyperactive children and found that at the end of one year the subjects were better able to withstand distractions. However, at the end of the second year without the structured environment, the children lost the advantages they had gained. Thus, long term planning for children with these behavioral tendencies may be needed.

The role of pharmacology in the management of children with attention disorders also is important (Grossman, 1966; Connors, 1973). While some studies indicate improvement in the child's ability to attend with medication more comprehensive long term studies are needed.

Although not all of the parameters of attention have been delineated Gardner (1966) states that disturbances may occur in (a) selective attention, (b) maintenance of attention, (c) momentary span of attention -- the ability to hold several things in mind at one time, and (d) attention deployment -- the scanning that an individual engages in before making a decision. This latter factor is related to the research on impulsivity and reflectivity conducted by Kagan (1965). He studied these behaviors by asking the child to

select a picture from an array that was the same as the model. His findings indicated that impulsive children tended to make more errors than those who were reflective. Several researchers who used Kagan's procedures found that learning disabled children were more impulsive and less reflective than normals (Keogh and Donlan, 1972; Hall, Kauffman and Bell, 1973; Nesbitt, 1974).

The implications for learning and early reading instruction are apparent. Children who have difficulty selecting relevant information or maintaining attention may have many problems in school. Some perform below the level of their potential. For example, an impulsive six-year-old made fifteen errors on an auditory discrimination test when it was given in standardized form. Later, using a different form, the examiner held the child's hand, encouraging him to look at all of the pictures before responding, and the child made only one error. The same child scored at a four-year-level on a picture vocabulary test when no structure was provided but he achieved at a six-year level when controls for the impulsivity were used. Group reading readiness tests need to be analyzed carefully because some learning disabled children impulsively mark figures without attending to all of the questions and possible responses. Similarly, the hasty scanner makes errors when he reads and may fail to comprehend.

Information overloading also may be considered a part of an attention disorder, though other factors may be involved. By overloading we refer to situations in which the child is unable to integrate multiple messages and, in some instances, to monitor his performance. One of the situations where we observe overloading in some children is during oral reading in context. Some children seem unable to perceive and assimilate the visual material, retrieve auditory responses and monitor their performance. They may be thinking one word while saying something else. For example, a student read a

passage in which the word "nuclear" occurred several times. Each time he substituted the word "muscular" yet he never corrected himself. After completing the passage we asked him to listen to a tape recording of his oral reading of the story and the printed material was removed so he only listened. The boy was quite surprised that he made the error and asked, "Did I really say 'muscular'? I was thinking 'nuclear' the whole time." We have observed similar tendencies in other learning disabled children and have found that a systematic program of monitoring is very beneficial. Children are asked to read passages; then they listen to themselves on tape and try to detect meaning errors. Next they listen to the tape with the printed passage before them and underline or note the errors. Many students have made marked progress with these techniques.

Although disturbances of attention may be found in many learning disabled children we also feel it is critical to examine attention with regard to the nature of the cognitive task. Kagan states that attention is best when the material is in keeping with the child's cognitive structure. Attention may wane when the content is either too difficult or too easy and uninteresting. Every teacher is aware of this fact but it becomes more crucial for children who have uneven patterns of development. Careful observation and diagnostic teaching is needed to determine which conditions and procedures foster maximum attention.

Perception

Research on the topic of perception is so vast that one cannot review many of the findings and parameters. Therefore, only a few areas will be discussed as they relate to early reading instruction and learning disabled children.

The first pertains to the active search for critical attributes as discussed by Gibson and Levin (1976). While this is an important factor in the perceptual development of all children, it appears that the nature of the search needs extensive study among learning disabled students. This need became apparent during some of our investigations on crossmodal perception. During the haptic portions of the studies we noted that the learning disabled children exhibited less exploratory behavior than normals of the same age. They tended to be more passive (Johnson, 1975). Therefore, we designed a study which involved video-taping of the hands of preschool normal and learning disabled children while they were engaged in the active exploration of familiar and unfamiliar objects. We analyzed the number and type of movements, the part of the hand and fingers used during exploration, the length of exploration and various verbal responses. In general, the learning disabled children demonstrated more fixating movements, more pressing, and less edging and searching for critical attributes (Johnson and Jans, 1973). They also had more difficulty attending to the intrasensory task. Frequently they tried to pull the object from behind the screen in order to see it. The examiners found that they had to say, "Don't peak" to the learning disabled children many more times than to the normals.

Further evidence of faulty exploratory behavior among learning disabled children came from parent interviews. Blalock and Johnson (1974) designed a questionnaire to investigate various aspects of play behavior among preschool learning disabled children. The results indicated that the parents of the learning disabled children observed less spontaneous, exploratory behavior and that their activities appeared to be more random than other children within the family.

More studies of both haptic and visual search behavior are necessary

to confirm these preliminary findings. In addition, studies of listening behavior, though much more difficult to design, are needed. Many tests of perception assess the product of perception; our goal is to determine more about the search and hypothesis testing of children who are suspected of having learning disabilities. It may be that the teacher should foster better exploration and provide more explicit statements regarding relevant features to which the child should attend.

Phonemic Discrimination. Phonemic discrimination, one aspect of perception, involves the ability to detect differences between minimally paired words or syllables. Essentially the teacher needs to know whether the child can distinguish between those sounds that signal a meaning change in our language. Several investigators have studied this skill in relation to reading but the results are inclusive. Harris (1962, 1970), Wepman (1960) and others report that children who fail to detect differences in sounds of words may have difficulty with the printed symbol. Flynn and Byrne (1970) found that retarded readers had more difficulty with auditory discrimination of words, nonsense syllables, and musical pitches than did advanced readers in the third grade. Atchison (1975) recently compared the performance of first grade normal and learning disabled children on several phonemic discrimination tasks. She constructed tests to explore various factors including the number of phonemic contrasts in words, position of the contrasting phoneme, and familiarity of stimulus items. Learning disabled children performed significantly below the normals but she found that a small sub-group contributed to most of the difference. Phonemic discrimination performance did not correlate significantly with reading achievement for either group of children. Both normal and learning disabled children performed better with lexically familiar words than with unfamiliar items. This factor is particularly important

to note if children have a limited vocabulary. Position of the phoneme contrast also was significant in Atchison's study. She found that both normal and learning disabled children were more successful in differentiating words with initial sounds than with final sounds.

Another process emphasized by Gibson and Levin (1975) is analysis or segmentation. This involves the ability to separate words into syllables or phonemes. The authors state that "fragmentation and recombination of sounds appear to be essential for mastery of the speech system and for decoding it to written symbols (page 228) ---- the child must be able to hear segmentation in what is spoken to him before we can reasonably expect him to learn to map the written code to speech or vice versa." But, according to Gibson and Levin, "young children do not automatically analyze the phonemic information in speech. Before five or so, they do not always hear words as subordinate units."

The importance of segmentation also has been stressed by Lieberman (1971) who states that before a child can map a visual message on the spoken word, he has to be consciously aware that a word such as "cat" has three elements. Savin states that in his experience "everyone who has failed to learn to read even the simplest prose by the end of the first grade has been unable to analyze syllables into phonemes," (page 321, 1972). These observations are in keeping with our clinical experience. Some very severe language cases cannot even segment words in sentences -- they give evidence of this by writing "uphere" as one word. We also have seen many adolescents and young adults with severe reading disorders who could not segment words into syllables. In some instances this problem affects spelling more than reading, particularly if the student uses visual skills and context. For example, a seventeen-year-old read the months of the year correctly but he spelled them as he

segmented them -- "Sep -- ter." At times, some students find that the presence of the visual pattern (the word) may facilitate perception of all the syllables or phonemes. Thus, the teacher must decide whether to work on intrasensory auditory segmenting or to combine the work with the printed word, perhaps by presenting the word in syllabic units or in phoneme patterns. Typically, we attempt to assess the most efficient stragegies during three weeks of diagnostic teaching.

Blending is another auditory process that is required for reading, particularly if a synthetic phonic method is being used. Although we have not completed the data gathering and analysis on learning disabled children's blending ability, our clinical experience and initial inspection of the data indicate that this is not as great a problem for poor readers as is segmenting. Both processes, however, should be investigated since decoding requires auditory and visual analysis as well as auditory synthesis. Because of these intermodal factors, we feel it is important to determine first whether the child can analyze and synthesize words auditorily and then bisensorially. In remediation, it is our practice to work with the media that is easiest for the child and progress to those skills that are more difficult for him.

Visual Discrimination. Visual discrimination tasks have long been included as a part of most reading readiness tests. It is assumed that children need to be able to detect similarities and differences between letters and words in order to read. Gibson (1969) and others have contributed significantly to our understanding of visual perception and its development in children. For example, Gibson and Levin (1976) report that children continue to progress in the discrimination of letter-like forms up to the age of eight but they found that the children do not confuse many letters even at four years of age. Calfee, Chapman and Venezky (1970) presented kindergarten

children with various letter matching tasks and found the major confusions were on right-left reversals such as b and d. When letter groups were tested, however, more errors were observed. The matching of letter strings and words is more difficult for kindergarten children because of the sequencing factor (Calfee et al., 1970).

Disturbances of visual perception have been reported among learning disabled and dyslexic children (Orton, 1937; Strauss and Lehtinen, 1947). Symptoms included reversals, figure-ground disturbance, and faulty sequencing. As a result of these problems, various tests have been constructed to assess some parameters of visual perception (Frostig, Lefever and Whittlesey, 1966; Colarusso and Hammill, 1972) and programs of intervention have been recommended. Visual problems and procedures have been examined more carefully in recent years and there is some indication that disturbances of visual perception may be found less frequently than once assumed. More difficulties might be attributable to linguistic or graphic/sound associations than to visual processes per se. Similarly, the programs of visual perceptual training that involve practice with geometric designs and other nonverbal figures have not always proved to facilitate reading acquisition. This does not, however, indicate that research on visual perception should be minimized. Newer models of perception may be used to study visual information processing in different ways. (Neisser, 1967; Sperling, 1960.)

Finally, although many learning disabled children appear to have adequate visual and phonemic discrimination, the special educator always must be aware that individuals may, indeed, have problems at this level, and that intervention should be provided.

Memory

The research on memory, like that on perception, is so vast and so interrelated with other cognitive processes that a comprehensive review is impossible. One needs to consider memory via various sensory modalities, immediate, short term, and long term memory, recognition versus recall, memory for sequence and other parameters. In this presentation, we will highlight only a few areas that have been of greatest concern in our work with children who have reading disabilities.

In a descriptive study of sixty dyslexic children (Johnson and Myklebust, 1965) reported that auditory memory disturbances predominated over visual impairments. As a group, the children were particularly deficient in Auditory Attention Span for Words from the Detroit Tests of Learning Aptitude (Baker and Leland, 1958). Their performance also was poor on Auditory Attention Span for Syllables. The latter task involves repetition of sentences and, therefore, may assess some parameters of syntax as well as memory span. These findings may be related to the fact that over half of this group had had some problems with oral language acquisition. These findings together with the significant investigations reported in Kavanaugh and Mattingly (1972) indicate the importance of studying the interrelationships between oral language and reading.

Many studies of memory also involve the retention of information in a sequence. Again, several investigations suggest that reading disabled children have problems with temporal sequencing (Vernon, 1971). In a recent study of good and poor readers Burns (1975) attempted to determine whether there were differences in sequential memory according to modality of input and output. Subjects were given sets of digits auditorily, visually, and bisensorially and with each set of inputs they were asked to give oral and/or

written responses. She found that the reading disabled subjects had difficulty with memory for a series irrespective of mode of input or output.

Other indications of sequencing problems were noted in the ability to say the days of the week or months of the year. Only thirteen subjects from a group of sixty dyslexics were able to say the months in order (Johnson and Myklebust, 1965). During remediation, the majority of these children were able to learn the series when the months were said rhythmically in groups of three.

Our clinical experience with adolescents and young adults with severe reading disorders suggests that sequencing disturbances persist if remediation is not provided. Many who came for diagnosis could not say the alphabet or the months of the year. They also had difficulty with the repetition of multisyllabic words, digits, and sentences. Typically, those with sequencing disorders mis-order sounds in words when they read and spell. A few, however, are aided in their temporal sequencing by seeing the printed word. They can retain the order of the sounds when they read because they have the entire image before them. This example again indicates the need for diagnostic teaching and the selection of inputs or media that will facilitate learning.

Another type of memory disorder found among language and learning disabled children is the problem of word retrieval. Many children understand words but cannot retrieve them for spontaneous communication. As a result, they may use circumlocutions, substitutions, or pantomime. Some use an overabundance of nonspecific words such as "stuff, what-cha-ma-call-it" and nonspecific pronouns (Johnson and Myklebust, 1967). While these problems frequently are associated with auditory disorders, the teacher should be aware of possible relationships with reading. Some youngsters have difficulty with

oral reading but they can read silently. Some may substitute meaningful words such as "cat" for "kitten"; others can define the words but cannot say them. For example, one student said when looking at the word "inspection," "I know that it means to look over something very carefully but I cannot say it." When learning letter names or sounds, the children may quickly point to the letter when it is said, but they cannot retrieve the name or sound. These disorders have been observed among preschool children by Jansky and DeHirsch (1972) and by Mattis, French and Rapin (1975) in older children and young adults.

In remediation, the children are provided with cuing techniques such as multiple-choice questions or the first sound of the word. In reading, the children may need more opportunities for recognition and association responses. Frequently we recommend that the initial sight vocabulary be composed of nouns and verbs so the children can have the opportunity to associate objects or pictures with the printed form.

Revisualization problems also are found among learning disabled children. These may be noted in spelling when the child is expected to revisualize letters or words. The teacher who uses writing to reinforce reading should be aware of possible difficulties, and might provide models of letters near the student to aid recall.

Reading instructors also should be aware of possible problems in cross-modal learning. Birch and Belmont (1964) and Birch and Leford (1963) stimulated considerable research on the subject of intersensory learning. They reported that retarded readers performed less successfully on tasks requiring auditory-visual integration. Although some questions have been raised regarding these conclusions by Bryant (1968) and others, it is our impression that comprehensive studies of children are needed to determine whether there are disturbances in intrasensory or integrative functions (Zigmond, 1966).

Symbolization and Conceptualization

One of the most critical aspects of learning to investigate is the child's ability to symbolize, that is, to understand that various sounds and figures can stand for something. Severe, global disorders of symbolization are detected early in childhood when a child fails to understand spoken words or sounds in his environment. Mild or moderate problems may not be detected until later when the child is expected to comprehend more difficult words or to read and write.

In research and diagnosis of learning disabled children the investigator should explore the breadth of the symbolic deficit, that is, whether the child has a generalized problem or one that is specific to reading. Some of our research indicates that many preschool children with auditory language disorders also have problems with the use of gesture (Knott, 1974). On the other hand, some children with severe language problems develop elaborate pantomime and may even respond to instruction with sign language.

Our clinical experience with children who were referred during the preschool years indicates that many of them later have difficulty learning to read, write, and calculate.

These observations and studies indicate that one should not view any single symbol system such as reading in isolation. Rather, one should investigate the comprehension and use of all symbol systems.

Since reading is often considered to be a visual symbol system superimposed on auditory language, it is particularly important to investigate many aspects of auditory verbal comprehension. This includes the ability to understand single words as well as connected speech. In general, children do not comprehend what they read unless they understand the spoken word. As indicated previously, children with severe auditory disorders will usu-

ally be identified before they enter school; however, mild to moderate problems may go undetected if the child acquires enough language for general conversation. Later, these children often are referred because of reading comprehension problems. Some youngsters fail to comprehend specific classes of words such as those representing space and time (e.g., between, below, middle, after). Others only have difficulty with more abstract vocabulary used in social studies and science, particularly superordinates such as "appliance" or "continent."

Initially some of these children may be quite deceptive because they may learn to "sound out" words rather quickly but they do not understand them. They are word callers and are sometimes called "hyperlexic" (Huttenlocher and Huttenlocher, 1973). Echolalic children may learn to "read" words as easily as they learned to repeat them. For example, an eight-year-old scored at the four-year level on a test of auditory comprehension but at an eight-year level on a measure of oral reading. The latter required no comprehension. His silent reading was limited to only a few words which he could match with pictures. These children appear to "transduce" from one sensory system to another without translating. When this occurs it is very important to assess silent reading comprehension or to ask the child what the word means or what the story is about after he has read it.

It is interesting to note that some of these youngsters cannot inhibit verbal responses on silent reading comprehension tasks. They must respond orally. Others are "overloaded" by oral reading tasks. Their reading comprehension deteriorates when asked to read aloud and they seem unable to monitor for meaning. In remediation comprehension is emphasized and oral reading is reduced.

Some children with symbolic deficits have no problems understanding

single words but they have difficulty with connected language or complex syntax. Failure to understand complex sentence structure, again, may be reflected in reading comprehension problems or in understanding of mathematical story problems.

During the past several years there has been a surge of interest and research pertaining to syntax. The theoretical constructs of Chomsky (1957) and others stimulated many studies on language development. They also provided the basis for test construction and programs of remediation (Lee, 1969; 1974; Lee, Koenigsknecht and Mulhern, 1975). These developments, together with new theoretical models of reading have fostered investigations regarding oral syntax and various facets of reading comprehension. Comprehensive systems of error analysis have been developed which aid the teacher in planning for children with problems (Goodman and Burke, 1972).

The educator should attempt to determine which syntactic and morphological rules the child has acquired and to what extent these rules are automatized. Although most normal children enter school with good language, many with learning disabilities have delayed or deficient linguistic systems. If they are presented with reading material containing complex syntactic patterns they may be unable to utilize contextual clues or to anticipate words in sentences.

Jansky (1975) reports that many young children who are "marginally ready" for school have difficulty with syntax on several levels. She says, "their sentence memory spans are short, they have some trouble following grammatically complex directions, and their own sentences are often fragmented and poorly constructed"..... the group of children we meet for the first time during the middle school years has trouble with sentences and this interferes with reading comprehension" (page 79).

Several studies confirm the relationships between syntax and reading (Golinkoff, 1975; Little, 1974). Cromer and Weiner (1966) and Weiner and Cromer (1967) are among those who found relationships between reading comprehension and syntax. Using the Cloze technique they found that the responses of poor readers were less syntactically correct than those of good readers. Kass (1966) found that subjects with severe reading disabilities were marginally deficient in the Grammatic Closure subtest of the Illinois Test of Psycholinguistic Abilities (Kirk and McCarthy, 1968).

An intensive investigation of several syntactic abilities in normal and dyslexic children were completed by Vogel (1975). She selected and/or devised nine measures of syntax and administered them to twenty normal and twenty dyslexic boys with reading comprehension problems. The age range was seven years and four months to eight years and five months. She grouped her tests into the following five categories: (1) recognition of melody pattern, (2) recognition of grammaticality, (3) comprehension of syntax, (4) sentence repetition, and (5) syntax and morphology in expressive language. She found the dyslexics were statistically different from the normals in recognition of melody pattern, sentence repetition, and syntax and morphology in expressive language. As a result of these findings Vogel emphasizes the importance of assessing syntactic ability when selecting reading materials. She states, " -- the most important implication for the teaching of reading is that meaning is conveyed primarily through the syntactic structure rather than the individual words. Syntax carries the burden of the message" (page 82). She also states that if "a child is having difficulty in reading comprehension, there is a high probability that his difficulty is related to syntactic deficiencies. Therefore, the assessment of syntactic ability should be included in the evaluation and diagnostic pro-

cedures" (1975, page 82).

Implications for Instruction

The overall program of reading instruction is based on the child's strengths and weaknesses. Although the goal is to teach all children to read, the initial approach varies with the nature of the disability. Many fall into one of two major categories -- those who are deficient in visual processes and those who are deficient in auditory learning. We have called the former group visual dyslexics. Characteristically they have a tendency to reverse, rotate, or invert letters, or transpose letters with words. Some attend to details within words, or to the general configuration but not both. Some have a reduced rate of visual perception. Most have visual memory problems which prevent them from remembering whole words. Because they cannot perceive and remember whole words, we use a synthetic phonic approach in remediation. Letter sounds are introduced, (a few consonants and short vowels) and the student blends them into meaningful words. Letter names are not used in the early stages, and few, if any rules are used. Rarely are associations such as "a for apple" used. The objective is to help the student unlock the code -- to convert the graphemes to phonemes as simply as possible. The form of the letters is kept constant since some children often find it difficult to read both upper and lower case print. Emphasis is given to simultaneous auditory and visual sequencing and to phoneme-grapheme relationships during the initial phase of instruction.

The basic approach to reading for the visual dyslexic circumvents his basic weakness and capitalizes on the strengths; however, work also is done to improve the deficit. A two-pronged remediation plan is used. The objective is to assist the child in both word attack and instant recognition.

In the past we found it was neither beneficial to bombard the deficit nor to raise all skills to a normal readiness level. Thus, the dual plan. However, even when working on a specific deficit such as visual perception or memory, one must consider the most effective "teaching circuit." If a child cannot perceive letters in the normal way he probably will not benefit from being given worksheets designed to improve visual perception. The teacher must decide how the materials can be used so that the child can, in fact, see the similarities and differences. At times color cues may be used. In other instances the size of the letters may be increased. In other cases taction, or extensive verbalization will be used to "lead the child's looking." The techniques are not selected at random, but are based on the child's pattern of strengths and weaknesses.

In contrast, the auditory dyslexic usually cannot learn phonics and therefore is taught to read whole words. Characteristically these children have disturbances in auditory perception, rhyming, blending, analysis, and memory. Although gross discrimination may be adequate they fail to perceive sounds within words. Many have difficulty with oral reading. Because of these learning patterns, the children are taught with an intrasensory visual approach during the initial stages of remediation. They are taught a sight vocabulary which consists largely of nouns and verbs -- that is words which can be associated with an object, experience, or picture. In this way no oral response is required. While some children benefit fr[illegible] saying the words aloud, others cannot concentrate on the visual image if they also must call up the auditory. Therefore, even when phrases and sentences are first introduced, the assignments are arranged so the child can match them with pictures rather than reading aloud. In some respects the approach is similar to that used in learning a foreign language. Words often are intro-

duced in units such as foods, clothing or transportation. Since no child can learn every word from visual memory, and since we want to help him with word attack, a dual approach also is used with this group. As soon as a child has a substantial sight vocabulary, every attempt is made to help him with the auditory skills so that he can decode unfamiliar words.

Our experience in recent years suggests that not all learning disabled children can be categorized in these broad groups. Hence, many variables must be considered in assessment and remediation. Various deficits interfere with the reading acquisition process, thus reducing the strategies that are needed for efficient reading. It is clear that the good reader has many options to identify words including phonics, structural analysis and context. One or more of the disturbances described above may interfere with certain aspects of reading but not others. For example, children with auditory comprehension problems may fail to acquire meaning yet they can decode. Some with syntax problems do not use contextual cues because they cannot anticipate words in context.

Therefore, several critical questions are raised with regard to early reading instruction.

(1) What is the nature of the input stimulation? Is it primarily visual; does it combine auditory and visual stimulation; are all sensory channels used simultaneously?

(2) What is the expected response from the child? Is he expected to match figures or to mark something? Is he expected to give an oral response? Does he need to know how to write?

(3) What is the nature of the vocabulary? On what basis were the words selected? How controlled is the vocabulary? Do the words have a consistent phoneme-grapheme relationship? How many meaningful words are used (specif-

ically nouns and verbs)? Is the vocabulary useful to the student? Can a recognition response be used?

(4) What is the nature of the sentence structure? Is it similar to the child's language? Is the sentence length beyond the range of his auditory memory span?

(5) What is the nature of the content? Is the material in keeping with the child's level of experience and interest?

(6) Does the method require deductive or inductive thought processes? Are rules learned explicitly or implicitly?

In addition to the preceding questions, the teacher analyzes reading books for other factors such as the size of print, the amount of material on a page, variations in letter case and size, spacing between words and lines, length of story, and nature of the pictures or illustrations.

These constitute but a few of the variables to consider when teaching learning disabled children. Others include the level of intelligence, language, and experience. As we learn more about children and about learning processes, undoubtedly more variables will be included in the plan. In essence, the learning disabled child may be likened to a special type of computer. The comput has a potential capacity for processing information. However, it will function properly when fed with a program which satisfies the necessary criteria for production. Although there are countless variables to control and consider when dealing with something as complex as the human brain and the reading process, the years ahead can be exciting as we study these variables in a more systematic fashion.

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OPEN DISCUSSION OF JOHNSON PRESENTATION

GLASER: Doris, aren't those a lot of etiological studies?

JOHNSON: The question of etiology always comes up. We routinely go through intensive case histories with this entire population, and I think it is not fully clear in all cases exactly what role etiology plays. In one of our studies of 60 reading disabled children, it looked as though there could be multiple etiologies, including genetic factors, difficulties at birth, and difficulties prenatally and sometimes postnatally. Those are generally the four big categories. I think there are variables we know nothing about.

We have an increasing number of familial cases now, and it's interesting that in some cases where we have two or three children in the family with a severe language disorder, the parents will say, "I had trouble with this area of learning." In one case, the father is an artist. He says he still has trouble with the pronunciation of multi-syllable words, with an auditory sequence, and you see very much the the same pattern in his youngsters.

F. SMITH: Can you give any indication of what proportion of the population has these problems?

JOHNSON: The figure tends to be 1% to 3%, but you will hear an incidence figure of 10% to 15% in some school systems. I prefer to deal with this hard core learning disabled population and have looked at that 1% to 3% as a reasonable figure.

MARTUS: How is the population distributed in terms of age of referrals?

JOHNSON: The children who come to our center are referred by a school, a physician, or the family. We are in a teaching-training institute, so we keep a cross section of all ages. At any one time, we would have 10 or 15 preschoolers, and the probably 10 or 15 elementary, high school, and adult levels. I did one study to look at the most frequent age of referral years ago. Age 9 was when the greatest number of children were referred. Those with severe oral language problems may be identified as early as 2. Those referred at the age of 2 tended to be siblings of children who already have language delays of some kind.

CHOMSKY: I guess we are looking at some of the better successes, fairly dramatic ones. What kind of success rate do you tend to have?

JOHNSON: Even success cases take a long, long time.

Recess